

Determination of API Gravity

1. Introduction

API gravity is a measure of the density of a petroleum liquid relative to water in arbitrary units (degrees, API) developed by the American Petroleum Institute. API gravity is equal to $[(141.5/\text{specific gravity at } 60^{\circ}\text{F}) - 131.5]$, and is measured using an Anton Parr¹ density meter. This instrument uses an oscillating U-tube with known harmonic properties which varies according to the density of the fluid sample placed in the tube. This measurement is commonly used, with other analytical results, to classify and type crude oil.

2. Interfaces with Other Methods

None

3. Materials and Equipment

Anton Paar DMA 4500 density meter
Chloroform, high purity
Syringes (disposable plastic or glass, 3ml)

4. Procedure

- Turn on density meter and allow 30 minutes to warm up.
- Record the dry air density (room air) for the day in the API gravity notebook. Acceptable air density is 0.00108 ± 0.00060 ; if reading is not acceptable, determine cause before continuing.
- The first API gravity measurement for the day should be an in-house standard. If the measurement is ± 0.2 degrees API or less of the known value continue with measurements; if not, discontinue analysis until issue is resolved.
- Wearing nitrile gloves and safety glasses draw into a disposable syringe approximately 3 ml of oil making sure there are no air bubbles. For samples in limited quantity, use a glass syringe to allow recovery after measurement.
- Place nozzle connected to waste chloroform/container into exit port of the density meter.

¹ Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

- Place syringe loaded with sample in the inlet of density meter, slowly depress plunger while viewing the U-tube and visually watch sample introduction into U-tube. U-tube must be totally filled and no air bubbles present to obtain an accurate reading. Wait for meter to make a measurement; record measurement in API gravity notebook.
- Repeat measurement 3 times if there is sufficient sample. If measurement varies by more than ± 0.5 degrees API determine cause of variance if possible (most likely an air bubble) and note in API gravity notebook. Repeat measurement. If measurement still varies by more than ± 0.5 , sample may not be suitable for measurement by the Anton Paar density meter. Analyst should refer to the instruction manual for advice. If the sample is not suitable for measurement by the Anton Paar density meter, alternative methods may be considered. Any measurement made with air in the sample should not be used.
- Push remainder of sample into chloroform/oil waste container unless sample is in limited quantity. For samples in limited quantity withdraw sample back into glass syringe and return sample to original sample container.
- Clean the U-tube by filling a clean syringe with approximately 3ml of chloroform and inject chloroform through the U-tube three (3) times. Clean around the entrance and exit ports with chloroform.
- Dry U-tube by placing in the inlet port the 'air' nozzle, turn on air, and allow air to push remainder of chloroform through the U-tube and into the waste container. Turn off pump; if the dry air density on the screen is ± 0.00005 of the initial recording of the day continue analysis of samples. If not, repeat chloroform rinsing step. If reading is still not within ± 0.00005 of the initial reading of the day discontinue analysis until cause is determined.
- Run an in-house standard after every ten samples and at the end of each day.
- Dispose of waste according to current USGS waste disposal policies.

5. Calibration and Quality Control Samples

- Instrument was calibrated when installed. If acceptance criteria listed in the procedure are not met, instrument must be recalibrated. Refer to Anton Paar manual, Chapter 8 for calibration procedure.
- Replicate analyses are performed if there is sufficient sample.
- Minimally one duplicate analysis per sample set is performed if there is sufficient sample material.
- In-house standards are analyzed. If the measurement is ± 0.2 degrees API or less of known value continue with measurements; if not, discontinue analysis until issue is resolved.

6. Limits, Precautions and Interferences

- This method is intended for oils liquid at room temperature. In cases where the oil is not liquid at room temperature, analyst discusses with submitter measures to be taken to obtain a reading and all exceptions to normal procedure are noted.
- Must have sufficient quantity of sample for analysis.
- Dirty U-tube will result in an inaccurate measurement.
- Air bubbles will result in an inaccurate measurement.
- Follow safe laboratory practices when analyzing samples. Nitrile gloves, safety glasses, lab coat and closed-toe shoes are minimally required. Minimize exposure to chloroform.

7. Acceptance of Data

If air density criteria is met (acceptable air density is 0.00108 ± 0.00060), in house standard criteria is met (± 0.2 degrees API or less of known value) and sample measurements do not vary by more than 0.5 degrees API then the results are acceptable.

8. Data Handling and Transfer

API gravity results are recorded in a laboratory notebook, placed in the proper Excel™ spreadsheet template and imported to the Sample Master database. Results are validated in the Sample Master database by the analyst and approved by appropriate laboratory personnel.

9. References

Anton Paar GmbH, 2002, DMA 4500/5000 Instruction Handbook, 114 pages.

10. Attachments

None.

11. History of Changes

R0: Initial Issue